

## CHARACTERIZATION OF HIGHLY CONTAMINATED SEDIMENT FROM THE GOWANUS CANAL, BROOKLYN, NEW YORK

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The Gowanus Canal is a 3 km long industrial waterway dating from the mid-19<sup>th</sup> century, constructed on the site of a natural tidal channel draining into New York Harbor. The canal received waste effluents from nearby industries (including oil refining, coal gasification, soap making and tanning) as well as input of domestic sewage. After some years of operation, in spite of the fact that the tidal range is about 2 m, it became apparent that tidal flushing was insufficient, leading to accumulation of noxious contaminants in the sediments. In 1911, to help remediate this problem, a flushing tunnel and pumping station were constructed at the head of the canal and operated for a half century. It was recently repaired and is back in operation. Even though much of the industrial activity along the canal has ceased, its sediments remain highly enriched in organic and inorganic contaminants, with combined sewer outfalls continuing to transport pollutants into the canal.

As part of a program of continuing sediment quality monitoring, a series of 10 grab samples were collected along the length of the canal. Standard environmental chemical analyses were performed (volatile and semi-volatile organics, PCBs, metals). For comparison, dried sediment samples were also analyzed by pyrolysis-gas chromatography/mass spectrometry (Py-GC/MS) and thermodesorption-gas chromatography/mass spectrometry (TD-GC/MS). Samples were quantitatively evaluated for the presence of benthic organisms.

Industrial metals (Cr, Cu, Pb, Zn) are present in elevated concentrations (several hundred mg/kg) in the samples. PCBs, however, were not detected. Parent (i.e., non-methylated) PAHs tend to be very abundant, up to several hundred mg/kg in one sample. Compared to most benthic sites of similar nature (depth, salinity, etc.) the samples are all low in biological diversity, low in numbers, and dominated by pollution tolerant organisms. These include capitellid polychaetes, particularly *Capitella cf capitata*, and the spionid polychaete *Streblospio benedicti*.

Py-GC/MS analysis permits a more complete characterization of the sedimentary organic matter, including biomass as well as the semi-volatile contaminants. The resulting data indicate that the sediments are strongly contaminated, to the point that signals from natural organic matter are overwhelmed. Three to five ring PAHs predominate in most samples, with parent and alkylated (up to C<sub>4</sub>) compounds of the phenanthrene, pyrene and chrysene series, in distributions characteristic of creosote. The dibenzothiophene and benzonaphthothiophene series attest to a significant organosulfur component. Abundant sterenes and fatty acids in sediment pyrolyzates indicate the presence of raw or partially treated sewage. Long chain normal alkanes are relatively minor constituents, in distributions that suggest fresh crankcase oil input to some samples. In spite of the recent reopening of the flushing tunnel, it is evident that acute sediment pollution persists in Gowanus Canal sediments.

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